ORIGINAL

Before the
Federal Communications Commission
Washington, D.C. 20554

In the Matter of	)	
	)	
Amendment of Parts 2 and 15 of the Commission's Rules Regarding Spread Spectrum Transmitters	)	ET Docket No. 96-8 RM-8435, RM-8608, RM-8609

COMMENTS OF CYLINK CORPORATION

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SUMMARY

Cylink Corporation urges the Commission to provide for the routine authorization of non-consumer outdoor point-to-point links in the 2.4 GHz and the 5.8 GHz bands at effective power above 6 dBw. Links of this kind use narrow beam directional antennas to focus energy in the desired direction and to minimize the possibility of interference. These links have been in operation for nearly four years without reported interference. Today, unlicensed spread spectrum equipment operating under Part 15 of the Commission's Rules supports point-to-point links that serve many beneficial activities. These include traffic light control and other Intelligent Transportation System applications, Internet connectivity for schools and libraries, rural telephone service that can be initiated on very short notice, emergency restoration circuits, telemedicine circuits and data links to tie together widely separated offices. Many of these have been designated as communications policy goals for nation in the Telecommunications Act of 1996. The changes sought by Cylink can be implemented without adversely affecting other spectrum users. As such, the Commission should move forward with revisions to the spread spectrum rules to accommodate non-consumer point-to-point links that operate in the 2.4 GHz and 5.8 GHz bands with a maximum transmitter output of one watt and with effective isotropic radiated power determined by antenna gain.

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COMMENTS OF CYLINK CORPORATION

Cylink Corporation ("Cylink") hereby submits its comments in response to the Commission's *Notice of Proposed Rule Making ("Notice")* in this proceeding, 11 FCC Rcd 3068 (1996). For the reasons set forth herein, Cylink urges the Commission to amend the Part 15 spread spectrum regulations to provide for the operation of non-consumer point-to-point links in the 2400 - 2483.5 MHz and 5725 - 5850 MHz bands at a maximum output power of one watt with effective radiated power to be determined by the type of antenna employed.

I. INTRODUCTION

Founded in 1984 and based in Sunnyvale, California, Cylink manufactures for use in the United States and worldwide a variety of spread spectrum equipment. Cylink's AirLink™ radios have been authorized to operate under Section 15.247 of the Rules with a waiver of the 6 dBw effective isotropic radiated power ("EIRP") requirements. This maintenance of the one watt output power limit coupled with the waiver of the EIRP limit makes it feasible for Cylink equipment to serve a variety of point-to-point communications needs over paths of

up to 30 miles (48 km) in the 2.4 GHz band and 24 miles in the 5.8 GHz band. Cylink urges the Commission to adopt regulations that permit non-consumer point-to-point links to continue to be implemented in the 2.4 and 5.8 GHz bands at more than 6 dBw. Such a change will ensure that local governments, utilities, schools, and businesses will continue to have flexible options to implement on short notice data links to provide important communications services in support of a host of beneficial activities.

II. POWER ABOVE 6 dBw WILL SERVE THE PUBLIC INTEREST

A change in the regulations to allow for the use of power above 6 dBw in non-consumer point-to-point links in both the 2.4 and 5.8 GHz bands will continue to afford a much-needed option for the implementation of digital links. Cylink outdoor point-to-point systems now support many activities that advance the public interest. These include intelligent transportation system communications links for traffic monitoring and signal light control, high speed Internet connectivity for schools, the linking of government offices, energy utility applications, telemedicine circuits, connection of cellular and PCS sites, and thin route T-1 common carrier links (often in rural areas). Indeed, the non-consumer point-to-point links made possible by Cylink equipment provide key infrastructure support for important policy objectives set forth in the Telecommunications Act of 1996. These include efforts to extend universal service, make advanced services available to rural areas, tie

remote clinics to more advanced health care facilities and link schools and libraries to the Internet.[1]

By using narrow beam directional antennas of moderate to high gain, Cylink equipment focuses energy in the desired direction along relatively long paths often in areas of significant ambient RF noise. If the maximum EIRP were limited to 4 watts, the length of a reliable 2.4 GHz path under ideal conditions would decrease from 30 miles to 5 miles (48 km to 8 km). Feasible systems at 5.8 GHz would decrease from 24 miles to 7.5 miles (38 km to 12 km).

This decrease in range carries with it severe "real world" consequences. For example, Cylink equipment has been selected by a regional Bell operating company as part of its commitment to improve service rapidly in rural areas. In many cases wireline plant is near maximum capacity or non-existent, and the cost of buried or aerial cable is prohibitive. Basic Exchange Telecommunications Service (BETRS) and Rural Radio offer only partial alternatives because of licensing delay, expense and more limited circuit capacity. Professional caliber equipment from Cylink stands out as a very cost effective means for quickly initiating multi-line circuits to serve new clusters of residences, schools, health clinics, construction sites, and commercial and industrial facilities. If conditions warrant, the Cylink radios can eventually be replaced by other circuits including licensed point-to-point equipment. In many cases, however, the Cylink equipment provides a viable long term solution.

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[1] *See e.g.* 47 U.S.C. §§ 230(b), 245(b) and (h).

Without the added range, the feasibility of using Part 15 spread spectrum equipment will be compromised by the need to employ multiple repeaters. This, in turn, increases the environmental impact of initiating service. It necessitates additional antennas atop natural high sites and/or the construction of towers. The need to use multiple hops to serve what currently can be served reliably with a single hop also creates additional delay in the provision of service as the logistics of additional sites are addressed. For example, in a rural setting a repeater requires acquisition of land rights for the site, approval by local planning boards, construction of a foundation for a hut to house the equipment, installation of a new tower in many cases, arranging for electrical power and security at the site, and even road construction. In an urban setting, the telecommunications industry is already witnessing resistance by local planning boards to the proliferation of antenna sites. Failure to amend the rules to provide for more than 6 dBw EIRP in both the 2.4 and the 5.8 GHz bands, however, would lead to the need to install more antennas and repeater systems.

In short, even though there sometimes are alternatives to the use of point-to-point spread spectrum links, these alternatives are often illusory because of the delay and expense associated with their implementation. Not only can spread spectrum radios be installed and tested within a short period of time without obtaining a license, the cost of a link is often about one-third that of other RF systems. For these reasons, many users have found the Cylink AirLink™ point-to-point radios preferable to any other approach. In this proceeding, the Commission has the opportunity to revise the regulations in ways that will routinize the application of this beneficial technology at the time it is needed most as one of the backhaul

solutions for PCS, cellular, and a host of competitive wireless technologies on an interim or long-term basis. For example, there are some 15,000 cellular sites in existence; the number continues to grow at about 5,000 per year. Some 60,000 PCS sites will likely be constructed over the next two to five years. Even if unlicensed spread spectrum radio is used to link only ten percent of these sites, the technology that Cylink and others offer will meet a major infrastructure requirement. Moreover, because these links can be deployed rapidly and on a relatively inexpensive basis, even their temporary use with later replacement by cable, fiber, or other RF links is in the public interest.

Power above 6 dBw for non-consumer point-to-point links is also needed to overcome growing ambient noise. In the 2.4 GHz band, Cylink conservatively estimates that some 60 million microwave ovens operate in the United States. The number of such devices will likely continue to increase. Noise from microwave ovens can have the effect of desensitizing communications receivers. This, in turn, can lead to interference or a loss of fade margin. Failure to maintain consistently adequate fade margin will decrease the reliablility of a spread spectrum system by causing it to fail during fades thereby limiting the amount of time the system provides reliable service.

The 2.4 GHz band in particular will likely become much noisier due to the growth of ISM equipment. The Commission has in the last two years seen the advent of a new highly efficient RF lighting technology. In ET Docket No. 94-32 the Commission was informed of the development of 2.4 GHz electrodeless sulfur lamps initially intended for high powered

commercial applications including outdoor lighting.[2] For example, the system that has been installed at the Forrestal Building in Washington lights an outdoor area and consumes about 12,000 watts of power versus the 42,000 watts that had been needed for the non-RF lights. A similar system has been implemented along high ceilings in the National Air and Space Museum on the Mall.

Like others producing equipment to operate on an unlicensed basis in the 2.4 and 5.8 GHz Industrial Scientific and Medical (ISM) bands, Cylink understands that Part 15 equipment must accept interference from other sources and not cause interference to licensed stations. At the same time, if this spectrum is to be used productively for both ISM uses and communications purposes, the ISM noise must be overcome. Without exceeding the one watt transmitter output power, narrow beam directional antennas provide a means for concentrating both transmitted and received energy in a manner that improves the signal-to-noise ratio of links operating in this spectrum so as to mitigate the adverse effects of noise from ovens, lighting, and other ISM applications.

Cylink and other manufacturers have been allowed to produce point-to-point equipment with EIRP of greater than 6 dBw for approximately six years. The current 6 dBw limit in Section 15.247 of the Commission's Rules was added in 1990 in the *Report and Order* in General Docket No. 89-354.[3] The 6 dBw limitation had not been proposed in the

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[2] Comments of Fusion Lighting, ET Docket No. 94-32, Dec. 19, 1996.

[3] 5 FCC Rcd. 4123 (1990).

Notice of Proposed Rule Making in that proceeding.[4] Instead, the power limit was adopted in response to concerns from some commenters that absent such a limit on spread spectrum operations in the three ISM bands there would be unacceptable interference. The Commission then chose the 6 dBi gain limit because "6dBi is equivalent to the maximum gain which is practically realizable with a simple vertical antenna that is omnidirectional in the horizontal plane."[5] At the same time, the Commission wisely provided for a long transition period to the new limit.[6] The imposition of the 6 dBi gain limit may have yielded some benefits in the 902 - 928 MHz band, which has grown increasingly congested with not only consumer and commercial Part 15 devices but also licensed LMS services The 2.4 and 5.8 GHz bands, however, have not been characterized by the same level of growth, but have been the proving grounds for non-consumer point-to-point links operating at power above 6 dBw. Now that this technology has shown that it can efficiently support a host of communications needs in support of a variety of Commission mandated policies, the regulations should provide for its accommodation on a regular basis.

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[4] 4 FCC Rcd 6370 (1989).

[5] 5 FCC Rcd at 4127.

[6] The Commission applied the transition provisions of Section 15.37 to the new regulations. Equipment continued to be approved under the old rules until June 23, 1992, was allowed to be manufactured until June 23, 1994, and since that date has been permitted under waiver for use only in non-consumer point-to-point links. As a result, the wisdom and versatility of permitting power above 6 dBw for this special category of applications has been proven in the period since the spread spectrum rules were last amended.

III. TECHNICAL ISSUES

A. Non-consumer Out-door Point-to-point Links With Power Above 6 dBw Can Be Operated in a Manner Compatible With Other Users.

Today, point-to-point links using equipment manufactured by Cylink and others operate throughout the United States in the 2.4 and 5.8 GHz bands. Thus far, there have been no reported cases of interference. While the lack of interference reports is not conclusive proof that interference can never result from such operations, it does illustrate the high degree of compatibility that has thus far been maintained. Non-consumer point-to-point operations are typically carried out from commercial rooftop sites and towers. Oftentimes, these same sites also house a variety of licensed mobile and fixed facilities.

The fact that 2.4 GHz non-consumer point-to-point operations are highly directional and located atop commercial buildings and towers works to keep most relatively high-powered links away from lower powered systems. In the case of wireless LANs, Cylink submits that a wireless LAN is more likely to desensitize a nearby 2.4 GHz point-to point systems rather than vice versa. The point-to-point link would have to be extremely close to the wireless LAN and aimed at the structure itself for potential interference to the wireless LAN to occur. Since the spread spectrum links depend upon clear line-of-sight transmission paths, such near-field interference conditions are. for all intents, extremely unlikely.[7]

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[7] A rooftop antenna, for example, would need to be elevated sufficiently that its path was not compromised in the Fresnel zone by interaction with a nearby building or ground effects.

Moreover, given building penetration and the fact that wireless LANs would likely be operating within a building using an omnidirectional emissions pattern, the more likely result would be that the wireless LAN would desense the spread spectrum point-to-point receiver through an increase in ambient noise.

In short, while the substantial benefits of permitting relatively long haul links for non-consumer point-to-point applications have been demonstrated in both the 2.4 and the 5.8 GHz bands, the interference problems hinted at in the *Notice* with respect to the 2.4 GHz band have not come to pass and are unlikely to do so.

B. RF Hazard Concerns Can Be Addressed Adequately Through Warning Labels and Through an Information to User Requirement.

The Commission has posited that Part 15 spread spectrum equipment operating at more than 6 dBw may exceed the agency's proposed standards and thereby be a potential health threat. In an effort to prevent such exposure, the Commission has suggested that proximity sensors may be an appropriate way to prevent such exposure. Proximity detectors would, in theory, shut off the transmitter before anyone comes close enough to the antenna to receive exposure in excess of the standard. To this end, the Commission sought comment on the use of proximity detectors or other means for reducing the potential for over exposure.

Unlike hand-held equipment or wireless LANs, the Cylink equipment would be installed so that antennas are not in locations routinely frequented by the public. Most such installations would occur atop buildings and towers. These sites are normally secure from

the general public. Frequently, these sites also serve licensed users, who are not constrained by the same output power limitation as Part 15. Maintenance personnel are normally the only persons to visit these sites. Indeed, the Cylink equipment specifically calls for professional installation by a technician. As such, the personnel most likely to be exposed infrequently to RF radiation from non-consumer point-to-point equipment are already cognizant of any concerns associated with working near radio transmitting equipment.

If it is determined that warnings in equipment manuals may not provide sufficient notice of the presence of RF radiation, Cylink would support a requirement that directional antennas be marked with the universal RF radiation hazard warning and that such labeling be visible sufficiently far away that personnel might be warned if they are entering an area in which the ANSI/IEEE C95.1-1992 Standard for exposure for workers might be exceeded.

Proximity detectors, however, are unnecessary, difficult to "fine tune" in many cases, and likely to lower the reliability of the system. The most likely sorts of proximity detectors are infrared systems of the kind commonly employed for home security purposes. While such devices work well for switching on lights in the presence of a possible intruder, application of such systems to non-consumer point-to-point operations would likely lead to reliability problems as the system is triggered by birds and other animals. Other schemes might use narrow infrared beams that would cross likely access paths on a rooftop site. In this case, however, the problem of false situations would also occur. To the extent that the proximity systems actually turn off the transmitter, the reliability of the system would be

compromised as a result of such false alerts.[8] If periodic exposure from such equipment is shown to be a potential hazard, a much better system would be to employ signs near the antennas to alert any persons of the presence of RF energy and the need to reduce or eliminate the source of such energy before working in the area covered by the warning. Such approaches are employed for non-consumer equipment in the licensed services. PCS base station equipment, which can operate on an omnidirectional basis and at power levels in excess of those employed for unlicensed point-to-point operations, is authorized after a showing by the manufacturer that with proper installation precautions the equipment can be operated in compliance with the ANSI/IEEE standards that the Commission has proposed to employ generally.[9] In the equipment installation manual, which is included in the equipment authorization application submitted to the FCC, manufacturers are required to explain the precautions that must be observed in order to install the equipment in a compliant manner. There is no reason this method could not be employed in this situation. Manufacturers should be required to include caution information in the instruction manual for installing such equipment.

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[8] Ironically, if a proximity system were used in a mobile environment to key the base transmitter to initiate communications when a vehicle came near a short range data system, for example, the same sort of reliability concern with the occasional false reading would not occur since the system would be turned on by the proximity detector, not switched off by it.

[9] 47 C.F.R. § 24.52 (1995).

C. The Commission's Proposal to Reduce the Output Power by 1 dB For Every 3 dB by Which Antenna Gain Exceeds 6 dBi Should Not Be Adopted.

The Commission proposed that when it does permit operation in excess of 6 dBw EIRP the transmitter output power be decreased by 1 dB for every 3 dB by which antenna gain exceeds 6 dBi. *Notice*, ¶ 15. In essence, the Commission would impose a sliding limit on the effective radiated power of a system. The limiting scheme proposed by the Commission should not be adopted. It will have the effect of undercutting the efficiency of systems designed to meet the requirements of local governments, businesses, and utilities for relatively long range point-to-point links.

Cylink's 2.45 GHz radios are currently available with an output power of 1.0 watts. Antenna gains of up to 24 dB are practical with higher gain antennas likely to become available. In the 5.8 GHz band, the output power of the Cylink equipment is 0.1 watts. Antenna gains of up to 41 dB are practical in the 5.8 GHz band. The Commission's proposal would reduce the EIRP from 54 dBm at 2.4 GHz to 36 dBm. At 5.8 GHz, EIRP would drop from 61 dBm to 36 dBm. The practical effect would be a significant decrease in usable range and a major reduction in the link margins required for reliable transmission at these frequencies. The result of these restrictions would be higher cost and significantly decreased ability to provide services to existing and new markets for Part 15 devices.

Likewise, the proposed limits on vertical and horizontal beamwidths are unnecessary. Part 15 manufacturers and installers are motivated by market forces to compensate for and to mitigate against any interference among themselves in order to achieve successful

installations. Similarly, they are compelled by the rules to accept interference from and not to cause interference to licensed users. There is no basis for designating beamwidth restrictions as a superior method to control the potential for interference.[10]

D. Short Hop Systems That Otherwise Qualify as Frequency Hopping Systems Should Be Permitted.

Not all transmissions will require that a system employ a full complement of frequency hops. So long as "short hop" systems are designed so that the system will hop to frequencies selected in a pseudorandom manner if presented with a data stream longer than can be accommodated in a single hop, short hop systems should be accommodated. The fact that the system may address a communications need that usually can be satisfied without hopping through a full complement of pseudorandom hops should not disqualify the system from being authorized under Section 15.247. It is logical that if the system can accomplish its transmission requirements in less than a full complement of hops, the system will have a lower potential to cause interference provided that the hopping frequencies are selected in a pseudorandom manner. The key to qualifying under Section 15.247 should be that when the system does transmit, it uses a frequency that had been selected on a pseudorandom basis.

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[10] There are situations in which horizontal and vertical beamwidths may, by design, be intended to be disparate in order to meet communications requirements. For example, Cylink equipment is employed to provide high capacity links from shore to off-shore platforms and tethered facilities and among such locations. In these cases, a horizontal pattern that is broader than the vertical pattern is used in order to compensate for movement caused by ocean waves working against the sites.

E. External RF Power Amplifiers Should Be Banned Except When Authorized as Part of a System.

Cylink supports the Commission's proposal to ban external RF amplifiers for Part 15 devices that are not certified as part of a system.[11] Unless authorized as part of a system, the risk of abuse is simply too great to permit the marketing of such equipment. When authorized as part of a system, the grant of equipment authorization should make clear that the amplifier is only approved for use with the other equipment included in the system. The Commission should not "grandfather" any unauthorized amplifiers that are being marketed.

External amplifiers have a legitimate but limited role to play in spread spectrum systems authorized under Part 15 of the FCC Rules. For example, in some cases it may make better sense from an engineering standpoint to use an external amplifier coupled almost directly to the antenna in order to overcome line losses and present the antenna with nearly a one watt input. In some cases, it may be preferable to design a system with separate subsystems rather than either to place the entire transmitter behind the antenna and mount both the transmitter and antenna on an inaccessible tower or to run a large low loss transmission line from the transmitter to the antenna. In cases in which an external amplifier is used, however, not only should it be authorized with the rest of the system, the manual should detail the correct manner for its installation, and the design of the amplifier should limit its output power so as not to exceed the maximum permitted one watt (or less if needed in order to accommodate limitations on EIRP).

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[11] Notice, ¶ 44.

IV. TRANSITION PROVISIONS SHOULD FOSTER FLEXIBILITY WITHOUT WORKING UNDUE HARDSHIP

The Commission has proposed to make the new regulations effective upon publication in the *Federal Register*.[12] Insofar as the new rules provide for increased flexibility not available in the current rules or policies, the new requirements should become effective upon publication in the *Federal Register*. To the extent that the new regulations have the effect of terminating flexibility now available to manufacturers, including the use of EIRP above 6 dBw, any such rules should provide for a reasonable transition period so that current contractual commitments can be met and existing inventory phased out in an orderly fashion. To this end, Cylink would urge the Commission to require that new regulations having a more restrictive effect be phased in over a twelve month period after publication in the *Federal Register*. This would afford time needed to complete projects that are already underway at the time new regulations are published and to alter product plans in an effort to accommodate the changes.

CONCLUSION

Part 15 unlicensed operations have assumed an increasingly important role in this nation's telecommunications infrastructure. In this proceeding, the Commission has an opportunity to revise the regulations governing unlicensed spread spectrum devices so as to increase the flexibility of manufacturers and users of such equipment in ways that will permit

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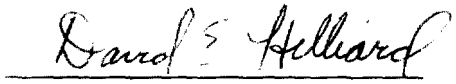
[12] Notice ¶ 45.

a growing list of communications needs to be met. Because non-consumer point-to-point systems operating in the 2.4 and 5.8 GHz bands at more than 6 dBw EIRP have proven to be viable means for meeting in a cost efficient manner a large number of important telecommunications requirements for governments, education, business, medicine, and utilities, Cylink urges the Commission to amend the rules to permit such operations to continue on a regular basis.

Respectfully submitted,

Cylink Corporation

By 

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